

I claim:

1. A slurry filtration apparatus including in combination:

a) a pressure filter apparatus comprising at least one upper plate with an internal cavity, at least one lower plate with an internal cavity, and a filter media, said plates adapted to close and seal against each other to form a pressurizable filtration chamber with said filter media between said plates, means for opening and closing said chamber by moving said plates with respect to each other, means for moving said filter media through the formed chamber when said plates are open, means for introducing fluids into said chamber when said plates are closed, means for withdrawing fluids from said chamber through said filter media and said lower plate;

b) a source of slurry to be filtered, means connecting said source to said means for introducing;

c) a plurality of means for performing pretreatment procedures on said slurry prior to introducing said slurry into said chamber;

d) means for analyzing characteristics of said slurry;

e) means for sensing temperature and pressure within said chamber when said plates are closed;

f) and a controller means for receiving information representing said analyzed characteristics, said controller including

    i) means for controlling said means for performing pretreatment procedures on said slurry,

    ii) means for controlling opening and closing of said plates,

    iii) and means for moving said filter media,

    iv) and means for controlling said means for introducing fluids and withdrawing fluids from said chamber.

2. The slurry filtration apparatus of claim 1 wherein said plurality of means for

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performing pretreatment procedures comprises,

- a) a source of heat for controlling said slurry temperature prior to filtration,
- b) a means for adjusting chemical characteristics of said slurry including adjustment in pH,
- 5 c) a means for introducing coagulant materials to said slurry,
- d) at least one means for introducing polymer materials to said slurry,
- e) at least one mixing means for mixing said pretreatment materials with said slurry to produce a treated and conditioned slurry,
- f) each of said plurality of means and said mixing means being controlled by said controller.

3. The slurry filtration apparatus of claim 1 with the addition of gas and liquid sources connected to said filter apparatus for introducing wash fluids, liquid clearing or cake forming gas, steam, or drying or conditioning gas for said chamber when said plates are closed.

15 4. The slurry filtration apparatus of claim 1 wherein each of said sources are under control of said controller and each source includes means for feedback information to said controller.

5. The slurry filtration apparatus of claim 1 including means within said chamber for sensing characteristics of cake formation within said chamber.

20 6. The slurry filtration apparatus of claim 1 wherein said liquid clearing or cake forming gas source includes controlled pressurized fluids for initially clearing free liquid from said slurry introduced into said chamber to form a filtration cake of solids from said slurry and to force said free liquid out of said chamber.

7. The slurry filtration apparatus of claim 1 wherein said steam source includes a steam generator for producing dry superheated steam at a controlled pressure and temperature above the gas/liquid phase of said steam for introducing dry steam into said chamber for extracting liquids from a cake formed in said chamber.

8. The slurry filtration apparatus of claim 1 wherein said drying or conditioning gas includes gas at a temperature and pressure for further drying of said cake and/or for controlling the temperature of said cake.

5 9. The slurry filtration apparatus of claim 1 including means under control of said controller for venting said chamber to reduce the pressure within said chamber after said wash fluids, or liquid clearing or cake forming gas, steam, or drying or conditioning gas have been introduced into said chamber.

10 10. The slurry filtration apparatus of claim 1 wherein said filter plate moving means for opening and closing said plates causes release of pressure within said chamber when said plates are separated and to seal said plates when said plates are closed to permit elevated pressure to be maintained within said chamber.

11. The slurry filtration apparatus of claim 1 including means for recycling heat from sources including sources external to said heat source.

15 12. The slurry filtration apparatus of claim 1 including means for recycling slurry filtrate from said filter chamber to said slurry source.

13. The slurry filtration apparatus of claim 1 including mixing means associated with each of said sources for mixing said source input with said slurry stream.

20 14. The slurry filtration apparatus of claim 1 wherein said coagulant source includes materials for selectively binding solids suspended within said slurry to assist in formation of interstices in said cake formed in said chamber.

15. The slurry filtration apparatus of claim 1 wherein said polymer sources include materials for selectively binding solids suspended said slurry to assist in selectively filtering said slurry.

25 16. A method for operating a pressure filter apparatus for separating liquids from solids in a slurry stream comprising the steps of:

a) analyzing the characteristics of said slurry,

b) controlling the temperature, chemical characteristics and viscosity of said slurry,

- c) adding and mixing materials to said slurry to coagulate, flocculate or precipitate solid materials in said slurry.
  - d) introducing said slurry stream of treated slurry into a closed chamber in said pressure filter, said chamber including a filter media and support porous means adapted to pass liquids of said slurry while retaining solids from said slurry,
  - 5 e) introducing slurry treating fluids to said chamber to pressurize said chamber, said treating fluids including wash fluids, liquid clearing or cake forming gases, steam, or drying or conditioning gas to said chamber to initiate separation of liquids from said slurry and form a filter cake of solids on said filter media,
  - 10 f) controlling said pressure within said chamber to facilitate passage of said introduced fluids through said filter cake,
  - g) controlling the pressure within said chamber to prepare for repeat venting or opening of said chamber,
  - 15 h) opening said chamber to permit said filter media to carry said filter cake from said chamber,
  - i) and repeating said steps of a) through h) for repeated processing of said slurry stream.
17. the method of claim 16 wherein each of said steps is performed under control by a controller having preprogrammed operating procedures and feedback information from each of said operating steps, said controller adapted to control said pre-treatment slurry steps and said steps of treating slurry within said pressurized chamber.
- 20 18. The method of claim 16 wherein said heating of said slurry stream is accomplished with recycle heat from within said process, from recompression of gases or fluids used in said method, and/or from external sources associated with said filter apparatus.
- 25 19. The method of claim 16 wherein said introduced steam is controlled in pressure

and temperature to maintain said steam in a gas state within said chamber for removing liquids from said formed cake, and then reducing the pressure or temperature of said steam to lower the temperature within said chamber before said chamber is opened.

- 5        20. The method of claim 16 wherein said filter apparatus is controlled in temperature prior to the introduction of said slurry to permit treatment of said slurry for liquid separation without causing said formed cake to become damaged, then increasing said pressure to further withdraw liquids from said formed cake, then reducing said pressure to cause formation of fissures within said formed cake to permit removal of additional liquids from said formed cake under gas pressure.
- 10        21. The method of claim 16 with the addition of a diaphragm within said closed chamber to contain said introduced slurry between said filter media and said support means, and means for compressing said diaphragm against said filter media to form said cake..
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